REMARKS

Applicants thank the Examiner for the thorough consideration given the present application. Claims 4-8 are currently being prosecuted. The Examiner is respectfully requested to reconsider his rejections in view of the amendments and remarks as set forth below.

Objection to the Specification

The Examiner objected to two phrases which he feels are unclear. In order to remove any possible unclearness, the Applicants have removed the word "side," so that the device is referred to only as a "monitoring device". Applicants have not used the Examiner's suggestion of referring to this as a "remote monitoring device" since that term is specifically used already in regard to element 25. The Applicant's have adopted the Examiner's suggestion of changing "detection data" to "detected data". These changes have been made throughout the specification, abstract and claims. Accordingly, Applicants submit that this objection is overcome.

Rejection Under 35 USC 102 and 103

Claims 1 and 2 stand rejected under 35 USC 102 as being anticipated by Summers et al (3,855,456). Claim 3 stands rejected under 35 USC 103 as being obvious over Summers et al in view of Gonzalez (Re 36,300). These rejections are respectfully traversed. Claims 1-3 have been cancelled by way of the present amendment and accordingly these rejections are now moot.

Applicants have added new claims 4-8 to replace the cancelled claims. These claims have been rewritten in more standard U.S. format and also now better define the invention. In particular, both independent claims 4 and 6 not only discuss the storage of the operating state data

and the failure data, but make it clear that a specified number of data sets are stored at intervals and old data is dropped as new data is added. In addition, these claims make it clear that additional data sets are added for a specific number of time intervals after the occurrence of the failure. These features are not seen in the cited references.

As shown in Fig. 2 of the corresponding description of the specification, Applicant's device stores a set of data at each time interval D1, D2, ... However, a maximum number of ten (or some other number) is stored at a time so that when new data is generated, the oldest data set is dropped. However, when a failure occurs the failure data is also stored and then two additional sets of data are received beyond the failure. This helps to define the failure state so that data is available from both sides of the failure. This aids the operator in determining the problem and guiding the repairer of the device.

The Examiner has pointed out that the Summers et al reference shows the detection of data at specified time intervals and also during failures. However, the reference does not include the storage of a set number of data points with the data being removed as it is added and with a second set of data points being added after a failure. Applicants submit that these features make the independent claims allowable.

Claims 5, 7 and 8 depend from these allowable independent claims as such are also considered to be allowable. In addition, claims 5 and 8 add an additional feature not discussed in the reference. That is, additional data points are added to the beginning of each control step. This is described in the Specification on page 16 starting at line 5. Since this feature is not shown in either of the references, Applicants submit that these claims are additionally allowable. For these reasons, Applicants submit that claims 4-8 are patentable.

VERSION WITH MARKING TO SHOW CHANGES MADE

IN THE ABSTRACT OF THE DISCLOSURE:

[The present invention aims at providing a] A method and apparatus for monitoring operation of a thermal device[,]. [which allow accurate understanding of the operating states up until occurrence of a failure.] The method includes [the steps of]: storing a sequence [detection] detected data on operating states and [detection] detected time thereof [as operating state data at specified time intervals]; storing [detection] detected data and [detection] detected time in the event of a failure [in a thermal device] as point-of-failure data; storing operating state data for a specified period of time [including failure occurrence time]; and outputting the same. The apparatus is equipped with detection means for detecting operating states[, processing means, storage means and output means]. The processing means stores in sequence [detection] detected data and [detection] detected time from the detection means in the storage means [as operating state data at specified time intervals], stores [detection] detected data and time in the event of a failure [in the thermal device] in the storage means, stores operating state data for a specified period of time [including the failure occurrence time], and outputs stored data to the output means.

IN THE SPECIFICATION:

The paragraph beginning on page 1, line 9 has been amended as follows:

An apparatus for monitoring operation of a thermal device such as a boiler is structured to monitor operating states of the boiler by storing [detection] detected data on vapor pressures, water levels, combustion states and exhaust gas temperature, as well as working states of control target devices such as a fuel valve, a blower and a feed water pump as operating state data at specified time

intervals. In the case of the halt of the boiler due to a failure, the operation monitoring apparatus is capable of storing operating state data at the time point of the failure occurrence as point-of-failure data and storing operating state data for a specified period of time until the failure occurs.

The paragraph beginning on page 3, line 1 has been amended as follows:

The present invention has been invented to solve the above addressed problem. In the first aspect of the invention, there is provided a method for monitoring operation of a thermal device, comprising the steps of: storing in sequence [detection] detected data on operating states at specified time intervals and [detection] detected time thereof as operating state data; storing [detection] detected data on operating states when a failure occurs in a thermal device and failure occurrence time as point-of-failure data; storing operating state data for a specified period of time including the failure occurrence time; and outputting stored operating state data and point-of-failure data.

The paragraph beginning on page 3, line 13 has been amended as follows:

In a second aspect of the invention, there is provided an apparatus for monitoring operating of a thermal device, comprising: detection means for detecting operating states of a thermal device; processing means, storage means; and output means, wherein the processing means stores in sequence [detection] detected data and [detection] detected time thereof from the detection means in the storage means as operating state data at specified time intervals, stores [detection] detected data on operating states when a failure occurs in the thermal device and failure occurrence time in the storage means as point-of-failure data, stores operating state data for a specified period of time including the failure occurrence time in the storage means, and outputs stored data in the storage means to the output means.

The paragraph beginning on page 4, line 3 has been amended as follows:

In a third aspect of the invention, the apparatus for monitoring operation of the thermal device further comprises a monitoring [side] device for receiving the point-of-failure data and the operating state data of the thermal device.

The paragraph beginning on page 4, line 22 has been amended as follows:

The embodiments of the present invention will be described hereinafter. Preferred embodiments of the invention are practiced with a thermal device such as a boiler. It will be appreciated that the boiler is structured to detect operating states including a vapor pressure, water level, combustion condition, exhaust gas temperature, and feed water temperature, as well as working stats of control target devices such as a fuel valve, a blower, and a feed water pump, based on which automatic operation control is implemented. Upon determination of a failure from each [detection] detected data, the boiler is so structured as to stop after executing specified operation, e.g., fire extinction by closing the fuel valve and post-purge by operation of the blower for a specified period of time.

The paragraph beginning on page 5, line 17 has been amended as follows:

The processing means performs sampling of [detection] detected data on the operating state from the detection means at specified intervals, and stores in sequence the [detection] detected data together with [detection] detected time thereof in the storage means as operating state data. In the event of a failure in the boiler, the processing means stores [detection] detected data at the time of the failure together with the time thereof in the storage means as point-of-failure data and also stores the operating state data for a specified period of time including the failure occurrence time in the storage means.

The paragraph beginning on page 6, line 3 has been amended as follows:

Upon an abnormal halt of the boiler, the processing means outputs the data stored in the storage processing means, e.g., the operating state data and the point-of-failure data, to the output means such as a display device or a printer. The output means displays or prints each [detection] detected data, a type thereof, [detection] detected time, and failure occurrence time stored in the operating state data and point-of-failure data, preferably in the form of a graph. Displayed or printed operating state data and point-of-failure data are used to understand the operating states of the boiler at the time of the failure. The operating state data and point-of-failure data include each [detection] detected time and failure occurrence time, which allows an operator to understand, with accuracy, a change in the operating states of the boiler with the lapse of the time before and after the failure occurrence, and facilitates identification of the cause of the failure.

The paragraph beginning on page 8, line 4 has been amended as follows:

In addition, the boiler may be connected to a monitoring [side] device for receiving the point-of-failure data and operating state data. The monitoring side device is connected to the boiler through either wire or wireless communications line. The monitoring [side] device may be installed in the same location or at vicinity of the boiler, or may be installed in a remote location. The monitoring [side] device may also be connected to a plurality of the boilers, for the monitoring the operation states of the boilers and identifying the cause of failures.

The paragraph beginning on page 10, line 1 has been amended as follows:

The storage means 15 is for storing an operating control procedure and an operating state monitoring control procedure of the boiler 1 as a program. The storage means 15 is structured to store each [detection] detected data from the water level detection means 10, the vapor pressure detection means 11, and the flame detection means 12, as well as the operating state of the fuel valve 4, the blower 6, and feed water pump 7 as data.

The paragraph beginning on page 10, line 9 has been amended as follows:

The communication device 17 is connected to a monitoring [side] device 20 via a wire or wireless communication line 19. The monitoring [side] device 20 is installed in the location adjacent to the installation site of the boiler 1 like a management station within the same facility as the boiler 1, or a management station distant from the boiler 1. The monitoring [side] device 20, consisting of, for example, a personal computer, is equipped with a display 21 and a printer 22 as output means.

The paragraph beginning on page 11, line 8 has been amended as follows:

Under the automatic operation of the boiler 1, the processing means 14 then performs sampling of operating state [detection] detected data B1, B2, ... at specified time intervals A based on the operation control procedure stored in the storage means 15. The [detection] detected data B1, B2, ... is stored in sequence together with [detection] detected time C1, C2 ... of the [detection] detected data B1, B2, ... in the storage means 15 as operating state data D1, D2, ... (see Fig.2).

The paragraph beginning on page 11, line 16 has been amended as follows:

The [Te detection] detected data B1, B2, ...consists of: [detection] detected [date] data on a water level, vapor pressure, and a combustion state obtained from each [detection] detected signal sent from the water level detection means 10, the vapor pressure detection means 11 and the flame detection means 12, and [detection] detected data on operating states of the fuel valve 4, the blower 6 and the feed water pump 7. The operating states of the fuel valve 4, the blower 6 and the feed water pump 7 may be detected based on control signals from the processing means 14, or detected from states of power supply to the fuel valve 4, the blower 6 and the feed water pump 7.

The paragraph beginning on page 12, line 21 has been amended as follows:

In the event of a failure of the boiler 1, the processing means 14 stores [detection] detected data on operation states BE and failure occurrence time CE in the storage means 15 as point-of-failure

data E. The processing means 14 also stores a specified unit number of the operating state data, e.g., two units of D11 and D22, in the storage means 15 after the occurrence of the failure. As a result, there are stored the point-of-failure data E and the operating state data D3 to D12 for a specified period of time F including the failure occurrence time CE in the storage means 15.

The paragraph beginning on page 13, line 7 has been amended as follows:

The processing means 14 transmits, via the communication device 17, the operating state data D3 to D12 and the point-of-failure data E to the monitoring [side] device 20. The monitoring [side] device 20 outputs the operating states of the boiler 1 at the time of occurrence of a failure as well as prior and subsequent thereto the display 21 or the printer 22 based on the operating state data D3 to D12 and the point-of-failure data E. The output data is preferably converted to the form visually easy to understand like a graph. Thus, an administrator of the boiler can easily determine the cause of a failure of the boiler 1 from the data indicated on the display 21 or printed by the printer 22.

The paragraph beginning on page 13, line 21 has been amended as follows:

Out of the operating state data D3 to D12 and the point-of-failure data E transmitted to the monitoring [side] device 20, Fig. 3 describes an example of flame detection data provided by flame detection means 12 displayed or printed with elapsed time. The flame detection means 12 detects a combustion state as a flame currency value. In Fig. 3 the vertical line represents detected flame currency values while the horizontal line represents time.

The paragraph beginning on page 14, line 3 has been amended as follows:

As described before, the operating state data D3 to D12 and the point-of-failure data E contain the detection time C3 to C12 and the failure occurrence time CE, respectively. Accordingly, [detection] <u>detected</u> data by the flame detection means 12 that is stored in the operation state data D3 to D12 and the point-of-failure data E can be indicated as a change in the flame currency value before

and after the occurrence of a failure corresponding to the [detection] detected time C3 to C12 and the failure occurrence time CE, as shown with a solid line in Fig. 3. In Fig. 3, the flame currency value is almost constant during the [detection] detected time C3 to C8, then gradually decreases from the [detection] detected time C8, and equals to "0" at the [detection] detected time C11 and thereafter.

The paragraph beginning on page 14, line 17 has been amended as follows:

If, as with the conventional apparatus, the failure occurrence time is not stored in the point-of-failure data E, it is not determinable at which point of time between the [detection] detected time C10 and C11 the failure occurred. Consequently, it is not determinable how the flame currency value changed before and after the failure occurrence time CE, especially between the [detection] detected time C10 and C11. In other words, it is impossible to determine if the flame currency value changed as shown with a solid line in Fig. 3, or if the failure occurred immediately after the [detection] detected time C10 and become "0" before the [detection] detected time C11 as shown with a dashed line in Fig. 3, or if the failure occurred immediately before the [detection] detected time C11 and rapidly descended to "0" before the [detection] detected time C11 as shown with a dotted line in Fig. 3. On the other hand, in the first embodiment, the operation data D3 to D12 and the point-of-failure data E contain the [detection] detected time C3 to C12 and the failure occurrence time CE, respectively, which provides accurate understanding of the change in the flame currency value with elapsed time before and after the failure occurrence time CE as shown with a solid line in Fig. 3.

The paragraph beginning on page 18, line 5 has been amended as follows:

The boiler installation facility 23 consists of specified number of the boilers 1 (three units in the second embodiment) and the monitoring [side] device 20. The monitoring [side] device 20 in the boiler installation facility 23 monitors and manages the operating state of the boilers 1 in the boiler installation facility 23..

The paragraph beginning on page 18, line 11 has been amended as follows:

On the other hand, the management facility 24 incorporates a remote monitoring [side] device 25 having the same structure as the monitoring [side] device 20. The remote monitoring [side] device 25 is connected to the monitoring [side] devices 20 via a communication line 19. A public telephone line or a dedicated telephone line may be used as the communication line 19 connecting between the monitoring [side] devices 20 and the remote monitoring [side] device 25.

The paragraph beginning on page 18, line 20 has been amended as follows:

According to the second embodiment, the monitoring [side] device 20 monitors the operating states of the boilers 1 in the boiler installation facility 23, and transmits the operating state data of the boilers 1 to the remote monitoring [side] device 25 through the communication line 19. Thus, the remote monitoring [side] device 25 can monitor the operating states of the boilers 1 in the boiler installation facility 23.

The paragraph beginning on page 19, line 3 has been amended as follows:

If either of the boilers 1 encounters with a failure and stops, the operating state date D3 to D12 for a specified period of time F including the failure occurrence time of the boiler 1 that encountered with the failure is stored in the storage means 15 of the boiler 1, and also transmitted to the monitoring [side] device 20 in the boiler installation facility 23. The monitoring [side] device 20 then transfers the data to the remote monitoring [side] device 25.

The paragraph beginning on page 19, line 12 has been amended as follows:

In the management facility 24, the remote monitoring [side] device 25 outputs the operating states of the boiler 1 that encountered with the failure before and after the failure occurrence time to the display 21 or the printer 22 to identify the cause of the failure. This way of visual identification of the failure allows a repairer to visit the boiler installation facility 23 with carrying appropriate tools

for repair. Accordingly, this embodiment saves the repairer trouble of visiting the boiler installation facility 23 twice: one time for identifying the cause of the trouble; and one time for bringing in appropriate tools for repair, or visiting the boiler installation facility 23 with carrying every tool and material necessary for coping with any expected causes of the failure.

The paragraph beginning on page 20, line 3 has been amended as follows:

In the second embodiment, the monitoring [side] device 20 is installed in the boiler installation facility 23. However, it will be understood that the boilers 1 may be directly connected to the remote monitoring [side] device 25 via the communication line 19 without the monitoring [side] device 20 installed in the boiler installation facility 23.

IN THE CLAIMS:

Claims 1-3 have been cancelled.

Claims 4-8 have been added.